TMDLs to Address Water Quality Impairments in the Appomattox River Watershed

Technical Advisory Committee Meeting

March 24, 2003

DEQ Introduction

- Central Office (TMDL introduction)
- Piedmont Regional Office (Discussion of Lower Appomattox Basin)
- Maptech (Technical approach for TMDL Development)
- Questions

Why Do We Need Total Maxiumum Daily Loads (TMDLs)?

- 1972 Clean Water Act (CWA)
  - Water Quality Monitoring
  - Periodic Assessment and Impaired Waters Listing based on Water Quality Standards
  - Develop TMDLs for Impaired Waters
- 1997 Water Quality Monitoring Information and Restoration Act (WQMIRA)
  - Requires TMDLs for Impaired Waters
  - Requires an Implementation Plan……

What is a TMDL?

- Amount of pollution a stream can receive and still meet water quality standards
- A TMDL Study identifies all sources of pollution
  - **Point source** pollution is discharged from a discrete location such as a pipe, tank, pit, or ditch
  - **Non-point source** pollution originates from diffuse areas (land surface or atmosphere) having no well-defined source
- Calculate the amount of pollutants entering the stream from each source, then calculate the pollutant reductions needed from each source to attain water quality standards.

What is a TMDL ?

A TMDL is a **pollution budget**:

TMDL = Sum of WLA + Sum of LA + MOS

Where:

- TMDL = Total Maximum Daily Load
- WLA = Waste Load Allocation (point sources)
- LA = Load Allocation (nonpoint sources)
- MOS = Margin of Safety

Required Elements of a TMDL

- Be developed to meet water quality standards;
- Be developed for critical stream conditions;
- Consider seasonal variations;
- Include wasteload and load allocations;
- Include a margin of safety (explicit or implicit);
- Consider impacts of background contributions;
- Be subjected to public participation; and
- Have reasonable assurance for implementation.

TMDL Public Participation

➔**Technical Advisory Committee (TAC) meeting to review available data and proposed modeling approach**

- Public meeting to announce beginning of TMDL development, 30-day comment period
- TAC meetings to review data, modeling approach and proposed allocations (July & September 2003)
- Public meeting to present draft TMDLs (January 2004), 30-day comment period
- Submit TMDLs to EPA for approval (No later than May 1, 2004)

Steps After TMDL Development

- EPA approval no later than June 1, 2004
- TMDL adopted by State Water Control Board
- Implementation Plan development: Specifies BMP type, # and location; currently developing guidance with DCR
- BMP implementation (voluntary for non-permitted activities) and follow-up monitoring

==> Ongoing opportunities for public input and participation

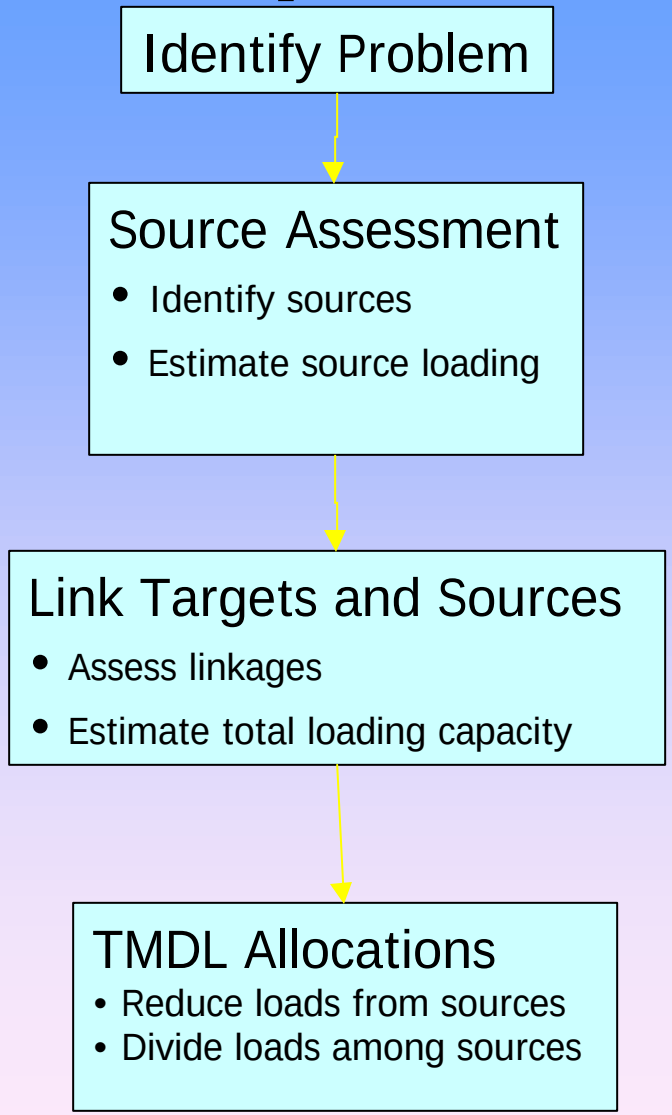
TMDL Implementation

- Implementation plans not required under CWA or by EPA's current regulations.
- DEQ is required by state legislation to develop implementation plan
- DCR has lead role in NPS implementation plans
- DEQ and DCR are developing framework for NPS TMDL implementation plans

Staged Implementation

- TMDLs include staged reduction targets
  - allows most cost-effective measures to be implemented first
  - allows iterative evaluation of TMDL adequacy in achieving water quality standard
  - last stage may require review/change of WQS

Components of TMDL Study



Identifying the Problem

- Identification and Listing of Waters on Impaired Waters List Are Based on Water Quality Standards.

- TMDL Development must result in meeting water quality standards

Water Quality Standards

- Standards Are Regulations Based on Federal and State Law That Set Numeric and Narrative Limits on Pollutants.

- Purpose of Standards is the protection of 5 designated uses:
  - Primary Contact Recreation,
  - Aquatic Life,
  - Fishing,
  - Shellfishing &
  - Drinking Water

Water Quality Standards: Bacteria Impairment

- The Primary Contact Recreation designated use is not met due to violations of the water quality standard for bacteria
  - Listed as impaired if more than 10% of samples exceed the criteria
  - Indicator was Fecal Coliform, as of January 15, 2003 *E. coli* is new indicator
  - Virginia and EPA have agreed on translator for TMDL model development

E. coli Criteria

- All Appomattox River bacteria TMDLs will be developed for E. coli using FC model and in-stream translator
- Single sample max: **235 counts/100mL**
  - applies for all samples collected
- Geometric mean: **126 counts/100mL**
  - applies for two or more samples taken during any calendar month

Water Quality Standard: Benthic Impairment

- The aquatic life use is not met due to violations of the General Standard:

  "All state waters shall be free from substances […] which are harmful to human, animal, plant or aquatic life." (9 VAC 25-260-20)

- Support of the aquatic life use is determined, in part, based on the biological assessment of the benthic community (= visible critters that live on the stream bed)

Benthic Impairments and TMDLs

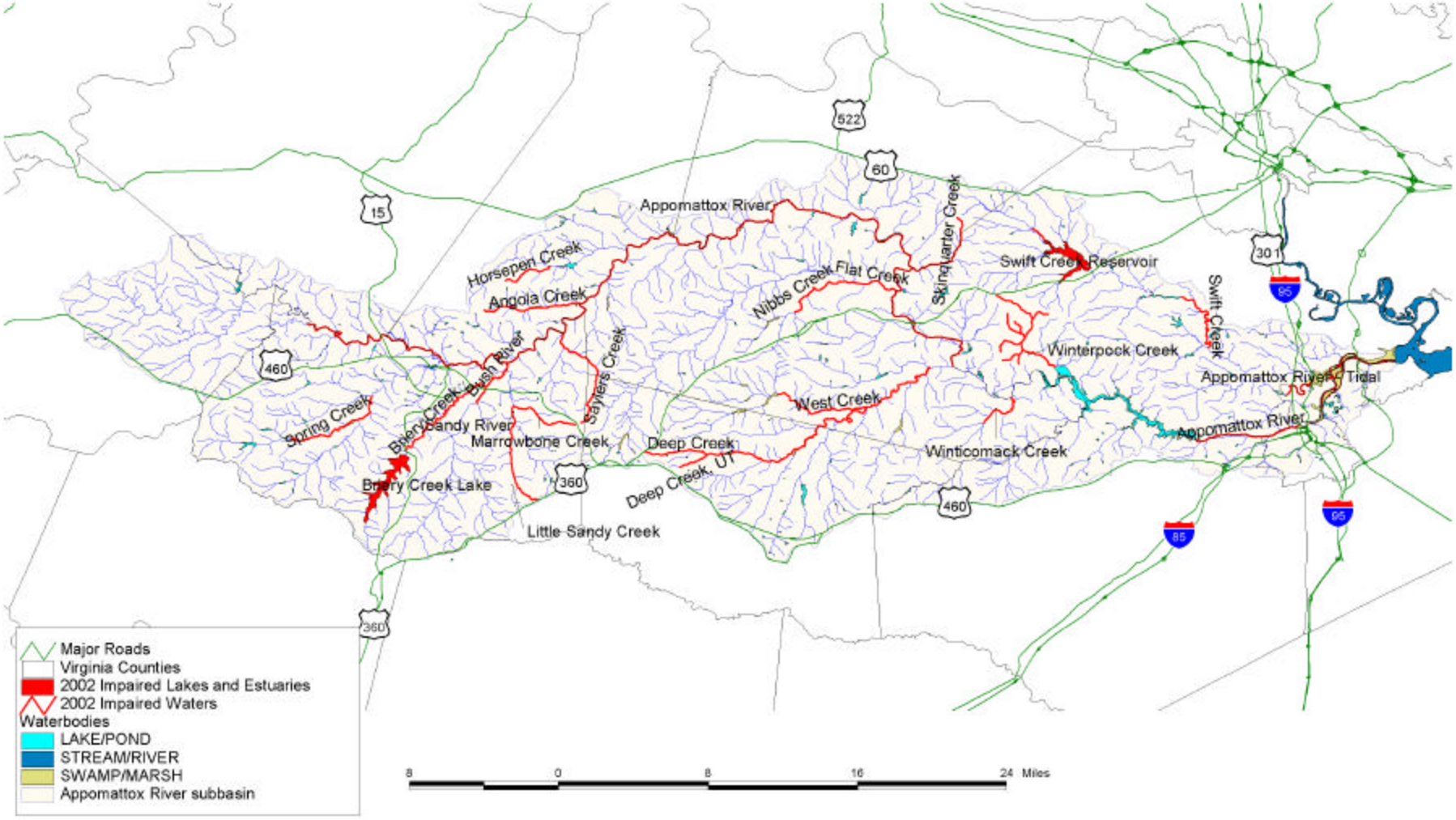
- After a benthic impairment is identified, more in-depth investigation must be done to identify:
  - the cause of the impairment, also called the **stressor**, and
  - the reductions necessary to restore the benthic community, also called the **TMDL endpoint**
- The TMDL endpoint is determined by comparing the impaired watershed to a **reference watershed**

Next Presentation

Impaired waters in the lower Appomattox River basin (DEQ - Piedmont Regional Office)

DEQ
Virginia Department of Environmental Quality

Appomattox River Subbasin
2002 TMDL Priority List Segments



Impaired Segments

Water Body	Cause	Listing Date	Listing Station	# violations / # samples since 1990
Appomattox Tidal	FC	1998	2-APP001.53	14 / 141
Appomattox R	FC	2002	2-APP012.79 2-APP050.23	16 / 141 27 / 144
Deep Ck	FC DO	1998 1998	2-DPC005.20 2-DPC019.03	3 / 55(E. coli 2 / 7) 16 / 36
Deep Ck-UT	BC	1994	2-XGP001.80	Benthic
Flat Ck	FC	1994	2-FLA001.95	11 / 57
Nibbs Ck	FC	2002	2-NBB001.54	1 / 7
Skinquarter Ck	DO, pH	1998	2-SQT001.54	13 / 39, 23 / 39
Swift Ck	FC FC, DO pH	2002 1998 1998	2-SFT004.92 2-SFT019.15 2-SFT036.00	5 / 54 4 / 40, 7 / 40 4 / 48, 16 / 54

Impaired Segments (cont'd)

Water Body	Cause	Listing Date	Listing Station	# violations / # samples since 1990
Swift Ck Reservoir	DO	2002	2-SFT031.08 2-SFT031.28 2-DYC000.19 2-SFT033.42 2-SFT034.38	12 / 37 4 / 13 4 / 46 3 / 23 2 / 21
West Ck	FC	2002	2-WET004.96	3 / 22
Winterpock Ck	DO, pH	1994	2-WPK003.23	32 / 88, 30 / 89
Winticomack Ck	DO, pH	1998	2-WTK001.50	24 / 59, 27 / 58

- www.deq.state.va.us
  - water programs
    - TMDL
      - 303(d) report

How are we approaching the TMDL?

BASIN WIDE APPROACH

- **If handled by 303(d) listing order: some Appomattox impaired tributaries would not get TMDLs for years after the Appomattox main stem implementation plan was developed.**
- **DEQ intends to develop the fecal TMDLs for the Appomattox and its impaired tributaries in an integrated, watershed-wide approach.**
- **If successful, this approach will be applied to other watersheds with multiple impaired tributaries (Dan, Banister, James, Roanoke).**

Current activity

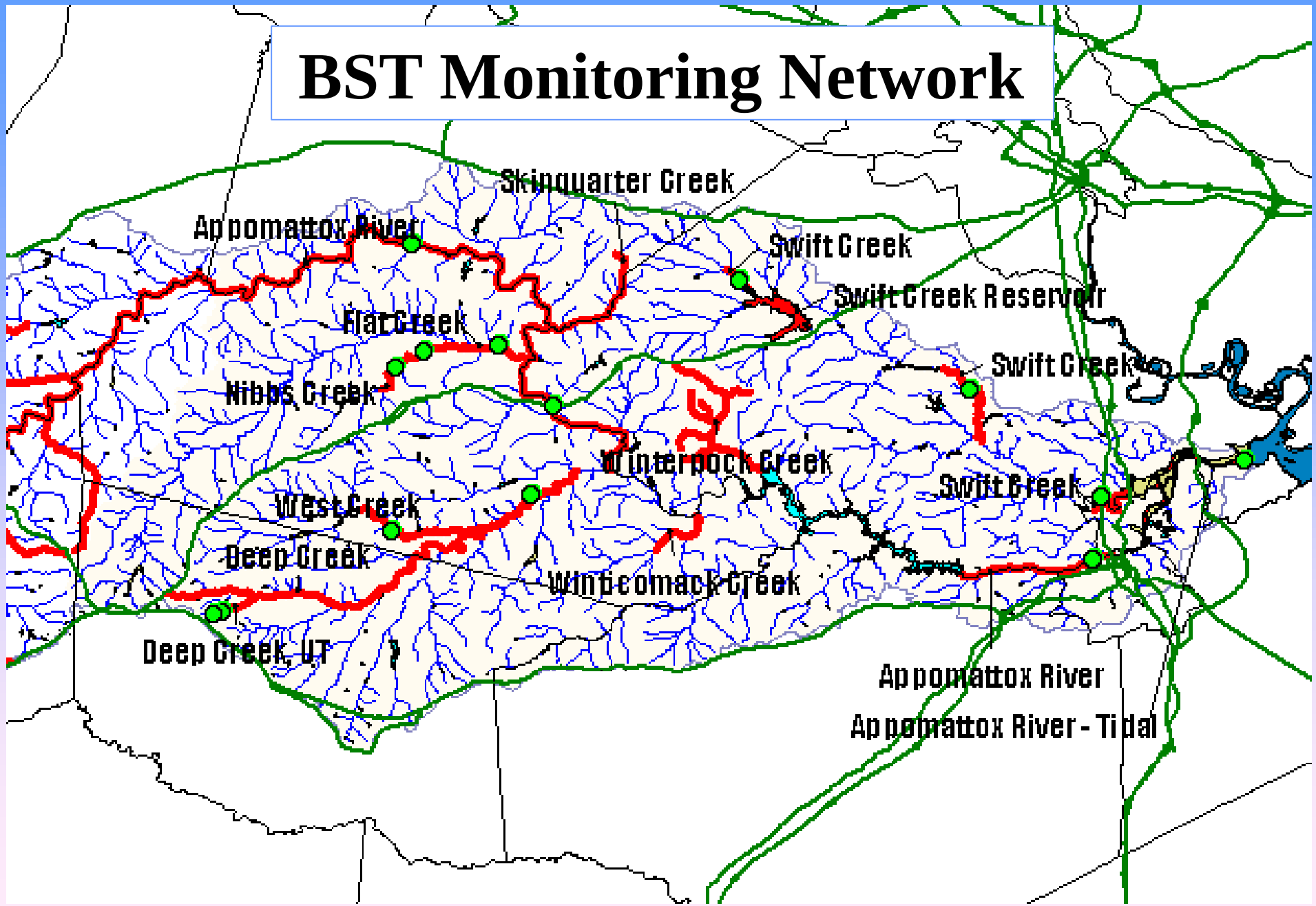
- **Monitoring (2002-2003)**
  - **46 stations**
  - **>250 visits/year**

- **Parameters**
  - **Field Parameters (D.O., Temp., pH, conductivity)**
  - **Nutrients, solids and bacteria at most stations**
  - **Benthic community at selected stations**

Current activity

- **TMDL Development**
  - **12/46 stations used for BST, Nov 2002 - Oct 2003**
    - Fecal Coliform
    - E.Coli
    - Bacterial Source Tracking (BST)
  - **Additional fecal and E.coli data from 22 stations**
  - **Benthic community at 6 stations**
- **DO & pH impaired waters being assessed**
  - **Natural Conditions? --> Delist**
  - **Exacerbated by anthropogenic inputs? -->TMDL**

BST Monitoring Network



What can you do as a stakeholder?

Get involved!

Participate in the TMDL process

Ask questions and make suggestions

Offer to provide and review local data

Volunteer for a local watershed advisory committee(s)

Support efforts to improve water quality in your watershed

Next Presentation

Technical approach for TMDL Development (MapTech)

this is where you can help...

DEQ
VIRGINIA DEPARTMENT OF ENVIRONMENTAL QUALITY

Appomattox River TMDL Development and Source Assessment

3/24/03

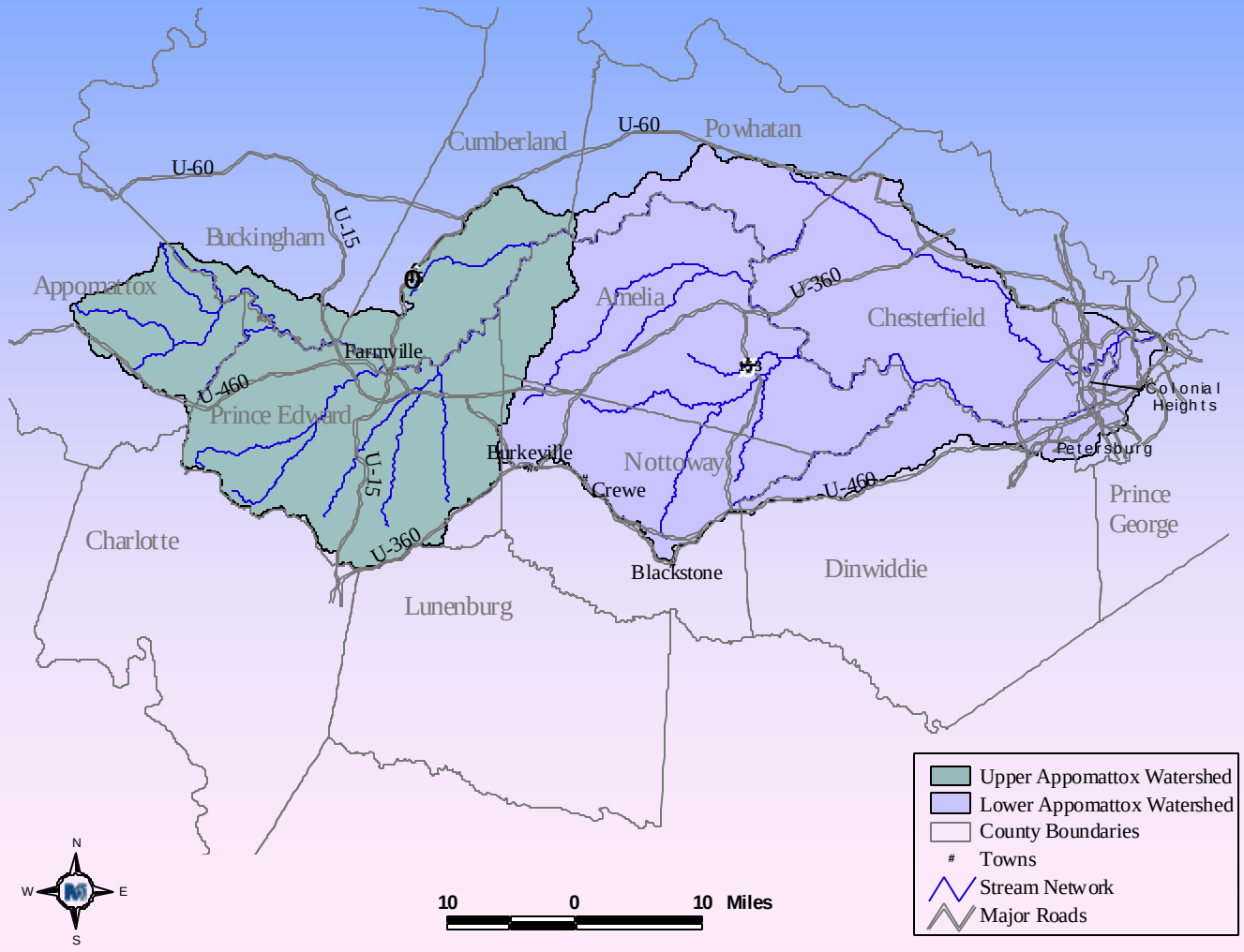
Project Background

- Teamed with Virginia Tech (Dr. David Kibler)
- 18-month project
- 19 Bacteria TMDLs
- 1 Benthic TMDL
- 10 DO & 4 pH source assessments
- Final report due to EPA by May 1, 2004

Appomattox River Background

- 10 counties, 3 cities
- 1,011,160 acres
- Appomattox basin divided between Upper & Lower
  - Drainage to Amelia, Cumberland, Powhatan borders

Appomattox River Watershed



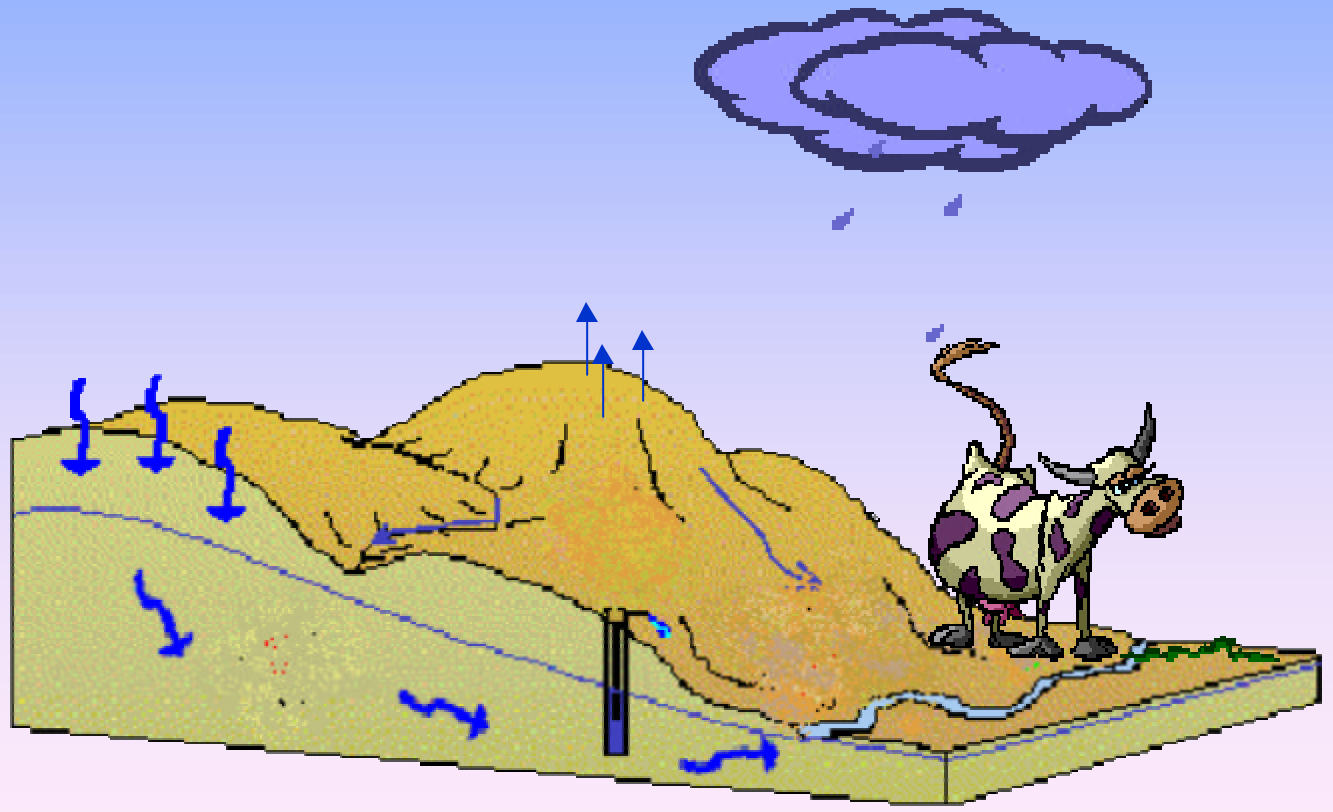
County Coverage: Upper Appomattox River

County	Acres	% of County
Amelia	26,540	11
Appomattox	61,777	29
Buckingham	22,206	6
Cumberland	67,406	35
Nottoway	1,978	1
Prince Edward	213,456	94

County Coverage: Lower Appomattox River

County/City	Acres	% of County
Amelia	203,146	89
Chesterfield	190,575	68
Colonial Heights	4,991	100
Dinwiddie	47,801	15
Hopewell	2,801	40
Nottoway	103,318	51
Petersburg	9,464	64
Powhatan	48,510	29
Prince Edward	524	0.2
Prince George	6,543	4

Modeling

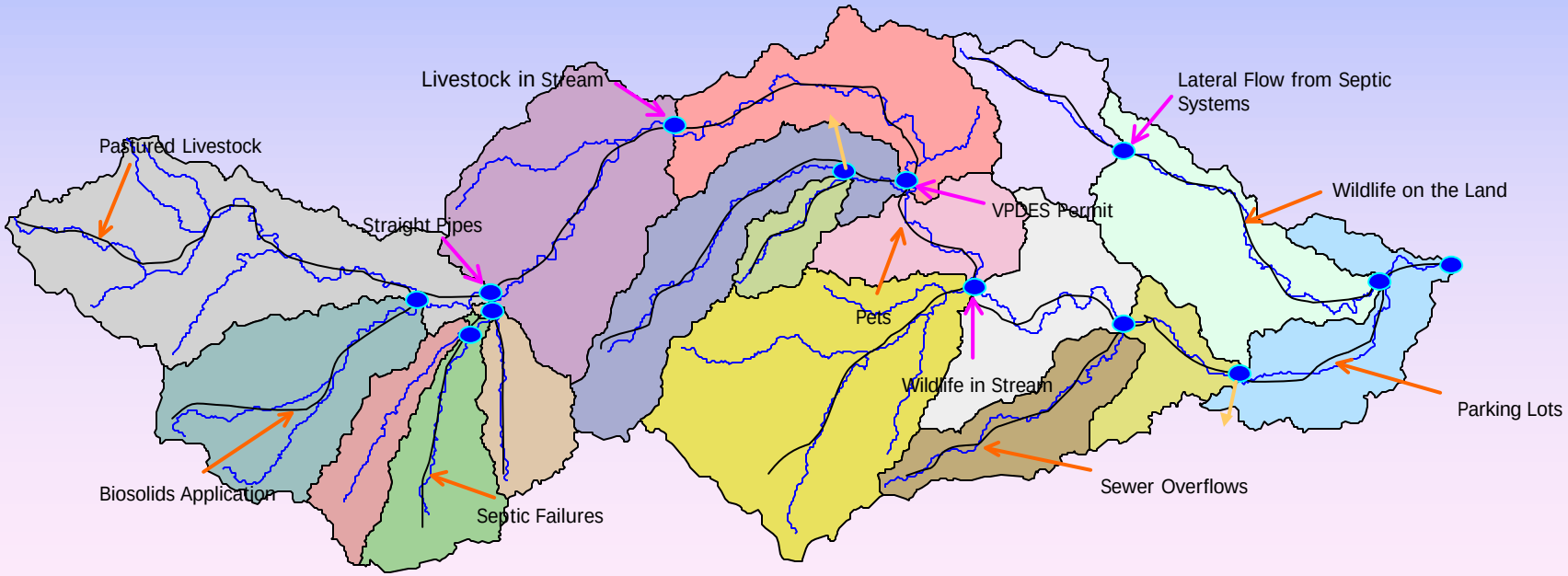


Models

- Non-tidal
  - Hydrologic Simulation Program – Fortran (HSPF)
    - Watershed-based
    - Continuous time interval
    - Land-applied, direct loads
- Tidal
  - Hydrologic Simulation Program – Fortran (HSPF)
  - In-stream?

Conceptual Model

- Mathematical Representation
- Overland
- Direct discharges
- Withdrawal



Hydrologic Modeling Components

- Climatic data
- Land use
- Topography
- Soils
- Stream channel characteristics
- Point source discharge/withdrawal
- Flow data

Water Quality Modeling Components

- Sources
  - Fecal Production
  - FC densities
  - FC distribution
- Delivery Mechanisms
  - Direct
  - Land-applied
- Temporal Variation

Source Assessment

- Permitted discharges
  - Wastewater treatment facilities
- Human
  - Biosolids
- Pets
- Livestock
- Wildlife

Permitted Discharges

- Chlorine / FC Translator
- Historical averages (DMR) for calibration period
- Design values for allocations
- Direct application

Human Source

- Population, HU, OSTS based on U.S. Census
  - Sanitary Sewer
    - Loading rates
      - Age, size, material of pipes
      - Overflows
    - Land-applied / direct deposition
      - Loading type
      - Proximity to stream

Human Source

- Septic Systems
  - Failure to soil surface throughout year
  - Lateral movement continuously to stream
- Straight Pipes
  - Direct continuous input into stream
- Biosolids
  - Land-applied

Pet Source

- Population/household based on literature values, veterinarians, and animal control
- Translated to HU based on U.S. Census
- Land-applied

Livestock Source

- Population
  - Virginia Ag. Statistics
  - Consultation with SWCD, NRCS, VADCR, producers
  - Watershed visits
- Distribution of waste
  - Pastured
  - Confined, waste collected, spread
  - Direct deposition to the stream
- Seasonal varying applications

Wildlife Source

- Population based on data provided by VDGIF biologists, include:

Raccoon	**Muskrat**	**Beaver**
Deer	**Turkey**	**Goose**
Mallard	***Minor Sources***	

- Distribution of waste based on habitat
  - Land-applied
  - Direct deposition to the stream
- Seasonal variations based on migration patterns and food sources

Benthic TMDL Development

- Stressor analysis
- Endpoints
- Reference watershed selection
- Source assessment
- Model similar to bacteria impairments

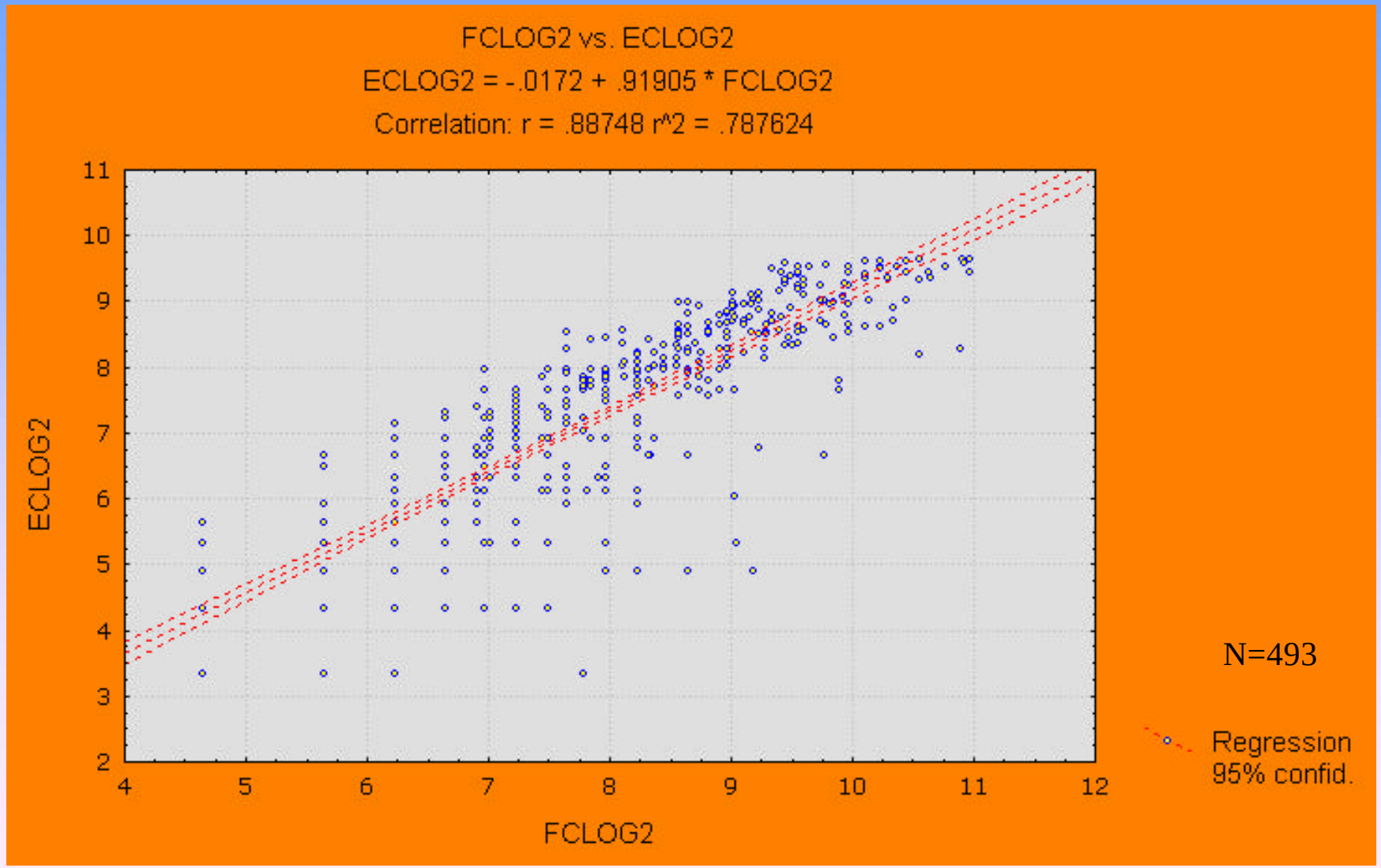
pH and DO Impairments

- Literature review of interactions, processes, and sources/sinks
- Spatial analysis
  - Land use characterization
- Compile historical water quality data
- Natural or anthropogenic

Questions/Announcements

- Format of final report (nontidal/tidal, Upper/Lower, above/below Lake Chesdin)?
- Sign up for E-mail updates before leaving today!
- 1st Public meeting for Upper Appomattox on **Tuesday, May 20, 2003, 7:30 p.m.** at **Hampden-Sydney College's Johns Auditorium.**
- 1st Public Meeting for Lower Appomattox, scheduled for May 22, but date and location to be finalized.

Verifying Compliance Using Translator Equation



Verifying Compliance Using Translator Equation

FC Concentration	*EC Concentration*
200	129
400	243
1000	565